

CLAIMS

What is claimed is:

1 1. A method for providing forwarding on ring-no-answer for remote
2 telephone extensions using voice over packet-data-network systems (VOPS),
3 the method comprising the step of emulating a tie-line over the packet data
4 network, wherein the emulation comprises passing a ringing state of a
5 telephone interface to a remote VOPS switched call control system (SCCS)
6 while maintaining the telephone interface in an on-hook state.

1 2. The method of claim 1, further comprising the steps of:
2 receiving a telephone call at the telephone interface from a private
3 branch exchange;
4 digitizing and compressing signals comprising the telephone call; and
5 transmitting the digitized and compressed signals over a wide area
6 packet data network.

1 3. The method of claim 1, wherein the step of emulating comprises the
2 steps of:
3 generating a ring signal at the telephone interface in response to the
4 telephone call;
5 passing the ring signal to a first VOPS SCCS;
6 asserting an offhook signal at the first VOPS SCCS in response to the
7 ring signal;
8 establishing a private line automatic ringdown to the remote VOPS
9 SCCS;

10 blocking transmission of the offhook signal to the telephone interface,
 11 wherein the telephone interface remains in an onhook state while the first
 12 VOPS SCCS sees the telephone interface in an offhook state;
 13 blocking the ring signal to the first VOPS SCCS in response to receipt of
 14 the offhook signal; and
 15 transmitting an artificial loop current signal to the first VOPS SCCS,
 16 wherein the first VOPS SCCS sees the telephone interface in an offhook state.

1 4. The method of claim 3, wherein the ring signal comprises a ringing
 2 voltage detection signal when the interface is a loop-start interface, wherein
 3 the ring signal comprises a tip-ground signal when the interface is a ground-
 4 start interface.

1 5. The method of claim 1, further comprising the steps of:
 2 removing the ring signal at the telephone interface;
 3 removing the artificial loop current signal at the first VOPS SCCS,
 4 wherein an indication is provided to the first VOPS SCCS that a disconnect
 5 supervision signal is present from the telephone interface;
 6 terminating the call attempt, wherein the first VOPS SCCS is placed in
 7 an onhook state and an onhook signal is transmitted;
 8 cease blocking transmission of the onhook signal to the telephone
 9 interface, wherein the first VOPS SCCS regains onhook control and offhook
 10 control; and
 11 cease blocking of the ring signal to the first VOPS SCCS in preparation
 12 for another call attempt.

1 6. The method of claim 5, wherein the ring signal is removed by a private
2 branch exchange upon cessation of a call attempt and upon call forwarding on
3 ring-no-answer.

4 7. The method of claim 1, further comprising the steps of:
5 receiving a call-answered signal from the remote VOPS SCCS at the
6 first VOPS SCCS;
7 cease blocking transmission of the offhook signal to the telephone
8 interface, wherein the telephone interface enters the offhook state;
9 removing the artificial loop current signal at the first VOPS SCCS;
10 pass a real loop current signal from the telephone interface to the first
11 VOPS SCCS;
12 cease blocking the ring signal to the first VOPS SCCS, wherein a real
13 ring signal is transmitted between the telephone interface and the first VOPS
14 SCCS; and
15 establishing call processing by the first VOPS SCCS.

1 8. The method of claim 1, further comprising the step of routing
2 integrated traffic comprising data, voice, video, Local Area Network-based,
3 and facsimile traffic, the step of routing comprising the steps of:
4 receiving at least one data stream, at least one voice channel, and at
5 least one video stream;
6 packetizing the received at least one data stream;
7 multiplexing the packetized at least one data stream, the at least one
8 voice channel, and the at least one video stream into a transport stream; and
9 providing the transport stream to at least one wide area packet data
10 network using a configurable trunk.

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1 9. The method of claim 8, wherein the at least one wide area packet data
2 network comprises Asynchronous Transfer Mode (ATM), Frame Relay, High-
3 level Data Link Control (HDLC), Internet Protocol (IP) networks, and Time
4 Division Multiplex (TDM) networks, and leased-line carrier services.

1 10. The method of claim 8, wherein the at least one data stream, the at
2 least one voice channel, and the at least one video stream are integrated into
3 the transport stream and transported over at least one network comprising
4 cell-based and packet-based multi-service networks.

1 11. The method of claim 10, wherein the at least one voice channel is split
2 out to an alternate network comprising a Public Switched Telephone
3 Network (PSTN) and a Time Division Multiplexed (TDM) network.

1 12. The method of claim 8, wherein the at least one voice channel is
2 received from at least one private branch exchange, at least one key system,
3 and at least one telephone, wherein the transport stream comprises a
4 plurality of channels of compressed voice.

1 13. The method of claim 8, further comprising the step of configuring the
2 configurable trunk at a physical level and a protocol level using at least one
3 trunk option, wherein configuring comprises using software to configure the
4 trunk among a plurality of service connections comprising T1 and E1, and
5 using software to allocate a plurality of trunk channels and time slots among
6 at least one multi-service network connection.

1 14. The method of claim 13, wherein a first trunk option provides
2 structured trunking comprising time slot mapping, wherein at least one time
3 slot is used for on-net traffic and services, wherein at least one time slot is
4 used for drop/insert pass-through of unprocessed Public Switched Telephone
5 Network (PSTN) traffic.

1 15. The method of claim 13, wherein a second trunk option comprises an
2 ATM trunk option, wherein all channels and time slots of the configurable
3 trunk are used for T1/E1 ATM.

1 16. The method of claim 8, wherein the step of receiving comprises
2 receiving the at least one data stream, the at least one voice channel, and the
3 at least one video stream from at least one port comprising at least one
4 Ethernet port, at least one serial port, at least one digital voice port, and at
5 least one analog voice port.

1 17. The method of claim 8, wherein the at least one voice channel
2 comprises combinations of compressed and Pulse Coded Modulation (PCM)
3 voice.

1 18. An apparatus for providing forwarding on ring-no-answer for remote
2 telephone extensions using voice over packet-data-network systems (VOPS),
3 the apparatus comprising at least one processor, wherein the at least one
4 processor is configured to control the apparatus to emulate a tie-line over a
5 packet data network by passing a ringing state of a telephone interface to a
6 remote VOPS switched call control system (SCCS) while maintaining the
7 telephone interface in an on-hook state.

1 19. The apparatus of claim 18, wherein the at least one processor is further
2 configured to control the apparatus to:
3 receive a telephone call at the telephone interface from a private
4 branch exchange;
5 digitize and compressing signals comprising the telephone call; and
6 transmit the digitized and compressed signals over a wide area packet
7 data network.

1 20. The apparatus of claim 18, wherein the at least one processor is further
2 configured to control the apparatus to emulate a tie-line by:
3 generating a ring signal at the telephone interface in response to the
4 telephone call;
5 passing the ring signal to a first VOPS SCCS;
6 asserting an offhook signal at the first VOPS SCCS in response to the
7 ring signal;
8 establishing a private line automatic ringdown to the remote VOPS
9 SCCS;
10 blocking transmission of the offhook signal to the telephone interface,
11 wherein the telephone interface remains in an onhook state while the first
12 VOPS SCCS sees the telephone interface in an offhook state;
13 blocking the ring signal to the first VOPS SCCS in response to receipt of
14 the offhook signal; and
15 transmitting an artificial loop current signal to the first VOPS SCCS,
16 wherein the first VOPS SCCS sees the telephone interface in an offhook state.

1 21. The apparatus of claim 20, wherein the ring signal comprises a ringing
 2 voltage detection signal when the interface is a loop-start interface, wherein
 3 the ring signal comprises a tip-ground signal when the interface is a ground-
 4 start interface.

1 22. The apparatus of claim 18, wherein the processor is further configured
 2 to control the apparatus to:

3 remove the ring signal at the telephone interface;

4 remove the artificial loop current signal at the first VOPS SCCS,

5 wherein an indication is provided to the first VOPS SCCS that a disconnect
 6 supervision signal is present from the telephone interface;

7 terminate the call attempt, wherein the first VOPS SCCS is placed in an
 8 onhook state and an onhook signal is transmitted;

9 cease blocking transmission of the onhook signal to the telephone
 10 interface, wherein the first VOPS SCCS regains onhook control and offhook
 11 control; and

12 cease blocking of the ring signal to the first VOPS SCCS in preparation
 13 for another call attempt.

1 23. The apparatus of claim 22, wherein the ring signal is removed by a
 2 private branch exchange upon cessation of a call attempt and upon call
 3 forwarding on ring-no-answer.

1 24. The apparatus of claim 18, wherein the processor is further configured
 2 to control the apparatus to:

3 receive a call-answered signal from the remote VOPS SCCS at the first
 4 VOPS SCCS;

5 cease blocking transmission of the offhook signal to the telephone
6 interface, wherein the telephone interface enters the offhook state;
7 remove the artificial loop current signal at the first VOPS SCCS;
8 pass a real loop current signal from the telephone interface to the first
9 VOPS SCCS;
10 cease blocking the ring signal to the first VOPS SCCS, wherein a real
11 ring signal is transmitted between the telephone interface and the first VOPS
12 SCCS; and
13 establish call processing by the first VOPS SCCS.

1 25. The apparatus of claim 18, wherein the processor is further configured
2 to control the apparatus to route integrated traffic comprising data, voice,
3 video, Local Area Network-based, and facsimile traffic, wherein the routing
4 comprises:
5 receiving at least one data stream, at least one voice channel, and at
6 least one video stream;
7 packetizing the received at least one data stream;
8 multiplexing the packetized at least one data stream, the at least one
9 voice channel, and the at least one video stream into a transport stream; and
10 providing the transport stream to at least one wide area packet data
11 network using a configurable trunk.

1 26. The apparatus of claim 25, wherein the at least one wide area packet
2 data network comprises Asynchronous Transfer Mode (ATM), Frame Relay,
3 High-level Data Link Control (HDLC), Internet Protocol (IP), and Time
4 Division Multiplex (TDM) networks, and leased-line carrier services.

1 27. The apparatus of claim 25, wherein the at least one data stream, the at
2 least one voice channel, and the at least one video stream are integrated into
3 the transport stream and transported over at least one network comprising
4 cell-based and packet-based multi-service networks.

1 28. The apparatus of claim 25, further comprising the step of configuring
2 the configurable trunk at a physical level and a protocol level using at least
3 one trunk option, wherein configuring comprises using software to configure
4 the trunk among a plurality of service connections comprising T1 and E1, and
5 using software to allocate a plurality of trunk channels and time slots among
6 at least one multi-service network connection.

1 29. The apparatus of claim 28, wherein a first trunk option provides
2 structured trunking comprising time slot mapping, wherein at least one time
3 slot is used for on-net traffic and services, wherein at least one time slot is
4 used for drop/insert pass-through of unprocessed Public Switched Telephone
5 Network (PSTN) traffic, wherein a second trunk option comprises an ATM
6 trunk option, wherein all channels and time slots of the configurable trunk
7 are used for T1/E1 ATM.

1 30. A computer readable medium containing executable instructions
2 which, when executed in a processing system, causes the system to perform
3 the steps of a method for providing forwarding on ring-no-answer for remote
4 telephone extensions using voice over packet-data-network systems (VOPS),
5 the method comprising the step of emulating a tie-line over the packet data
6 network, wherein the emulation comprises passing a ringing state of a

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7 telephone interface to a remote VOPS switched call control system (SCCS)
8 while maintaining the telephone interface in an on-hook state.

1 31. The computer readable medium of claim 30, wherein the method
2 further comprises the steps of:

3 receiving a telephone call at the telephone interface from a private
4 branch exchange;

5 digitizing and compressing signals comprising the telephone call; and

6 transmitting the digitized and compressed signals over a wide area
7 packet data network.

1 32. The computer readable medium of claim 30, wherein the step of
2 emulating comprises the steps of:

3 generating a ring signal at the telephone interface in response to the
4 telephone call;

5 passing the ring signal to a first VOPS SCCS;

6 asserting an offhook signal at the first VOPS SCCS in response to the
7 ring signal;

8 establishing a private line automatic ringdown to the remote VOPS
9 SCCS;

10 blocking transmission of the offhook signal to the telephone interface,
11 wherein the telephone interface remains in an onhook state while the first
12 VOPS SCCS sees the telephone interface in an offhook state;

13 blocking the ring signal to the first VOPS SCCS in response to receipt of
14 the offhook signal; and

15 transmitting an artificial loop current signal to the first VOPS SCCS,

16 wherein the first VOPS SCCS sees the telephone interface in an offhook state.

1 33. The computer readable medium of claim 32, wherein the ring signal
2 comprises a ringing voltage detection signal when the interface is a loop-start
3 interface, wherein the ring signal comprises a tip-ground signal when the
4 interface is a ground-start interface.

1 34. The computer readable medium of claim 30, wherein the method
2 further comprises the steps of:
3 removing the ring signal at the telephone interface;
4 removing the artificial loop current signal at the first VOPS SCCS,
5 wherein an indication is provided to the first VOPS SCCS that a disconnect
6 supervision signal is present from the telephone interface;
7 terminating the call attempt, wherein the first VOPS SCCS is placed in
8 an onhook state and an onhook signal is transmitted;
9 cease blocking transmission of the onhook signal to the telephone
10 interface, wherein the first VOPS SCCS regains onhook control and offhook
11 control; and
12 cease blocking of the ring signal to the first VOPS SCCS in preparation
13 for another call attempt.

1 35. The computer readable medium of claim 34, wherein the ring signal is
2 removed by a private branch exchange upon cessation of a call attempt and
3 upon call forwarding on ring-no-answer.

1 36. The computer readable medium of claim 30, wherein the method
2 further comprises the steps of:

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receiving a call-answered signal from the remote VOPS SCCS at the first VOPS SCCS;

cease blocking transmission of the offhook signal to the telephone interface, wherein the telephone interface enters the offhook state;

removing the artificial loop current signal at the first VOPS SCCS;

pass a real loop current signal from the telephone interface to the first VOPS SCCS;

cease blocking the ring signal to the first VOPS SCCS, wherein a real ring signal is transmitted between the telephone interface and the first VOPS SCCS; and

establishing call processing by the first VOPS SCCS.

37. The computer readable medium of claim 30, wherein the method further comprises the step of routing integrated traffic comprising data, voice, video, Local Area Network-based, and facsimile traffic, the step of routing comprising the steps of:

receiving at least one data stream, at least one voice channel, and at least one video stream;

packetizing the received at least one data stream;

multiplexing the packetized at least one data stream, the at least one voice channel, and the at least one video stream into a transport stream; and

providing the transport stream to at least one wide area packet data network using a configurable trunk.

38. The computer readable medium of claim 37, wherein the at least one wide area packet data network comprises Asynchronous Transfer Mode (ATM), Frame Relay, High-level Data Link Control (HDLC), Internet Protocol

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4 (IP), and Time Division Multiplex (TDM) networks, and leased-line carrier
5 services.

1 39. The computer readable medium of claim 37, wherein the at least one
2 data stream, the at least one voice channel, and the at least one video stream
3 are integrated into the transport stream and transported over at least one
4 network comprising cell-based and packet-based multi-service networks.

1 40. The computer readable medium of claim 39, wherein the at least one
2 voice channel is split out to an alternate network comprising a Public
3 Switched Telephone Network (PSTN) and a Time Division Multiplexed
4 (TDM) network.

1 41. The computer readable medium of claim 37, wherein the at least one
2 voice channel is received from at least one private branch exchange, at least
3 one key system, and at least one telephone, wherein the transport stream
4 comprises a plurality of channels of compressed voice.

1 42. The computer readable medium of claim 37, wherein the method
2 further comprises the step of configuring the configurable trunk at a physical
3 level and a protocol level using at least one trunk option, wherein
4 configuring comprises using software to configure the trunk among a
5 plurality of service connections comprising T1 and E1, and using software to
6 allocate a plurality of trunk channels and time slots among at least one multi-
7 service network connection.

1 43. The computer readable medium of claim 42, wherein a first trunk
2 option provides structured trunking comprising time slot mapping, wherein
3 at least one time slot is used for on-net traffic and services, wherein at least
4 one time slot is used for drop/insert pass-through of unprocessed Public
5 Switched Telephone Network (PSTN) traffic, wherein a second trunk option
6 comprises an ATM trunk option, wherein all channels and time slots of the
7 configurable trunk are used for T1/E1 ATM.

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